Foundation block

Cell Mediated Immunity

Lecture 3

Objectives:

- To describe antigen recognition by T cells.
- To describe the pathways involved in processing endogenous and exogenous antigens.
- To discuss self MHC restriction in Ag presentation to T cells.
- To describe the induction of cell meditated immunity (Chronic Inflammation).

Note:

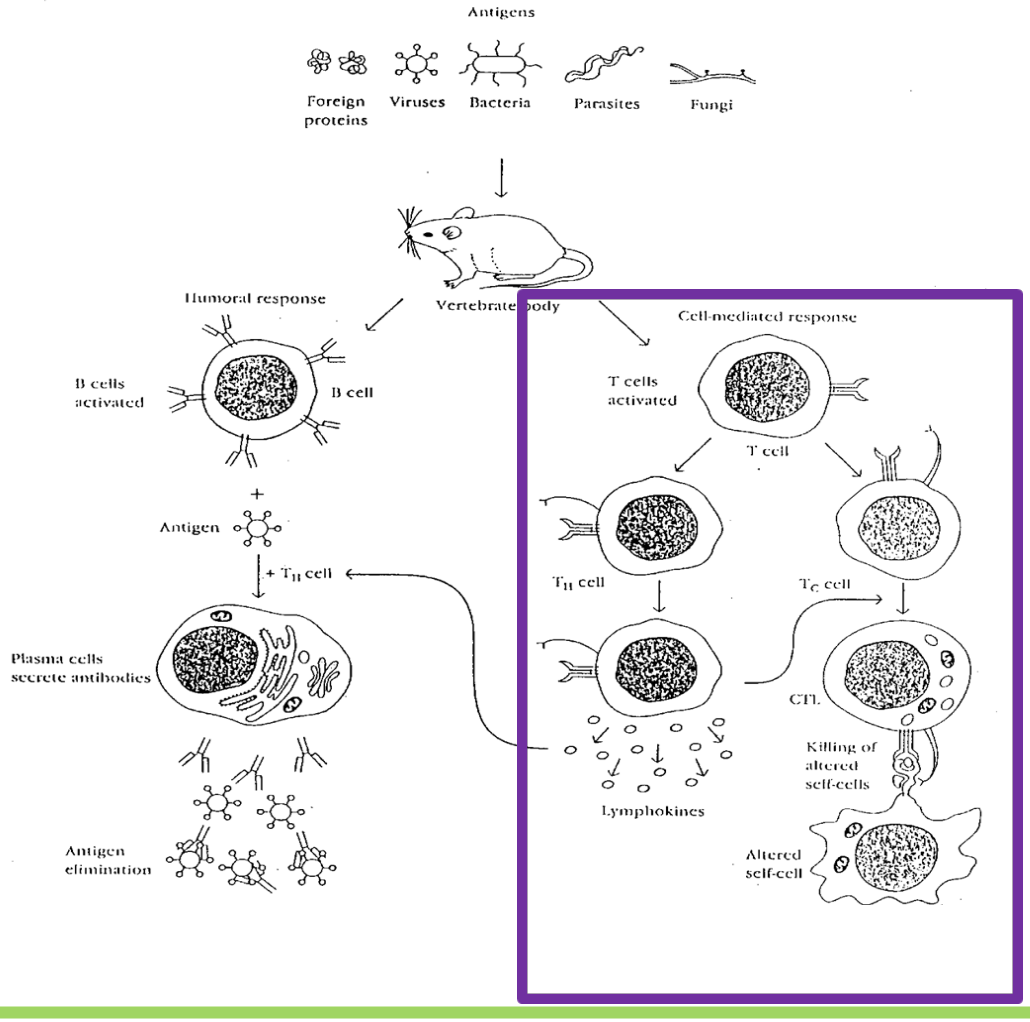
Black: Slides

Orange: Explanation

Purple: Extra

Red: Important

○ Cell mediated immunity (CMI):



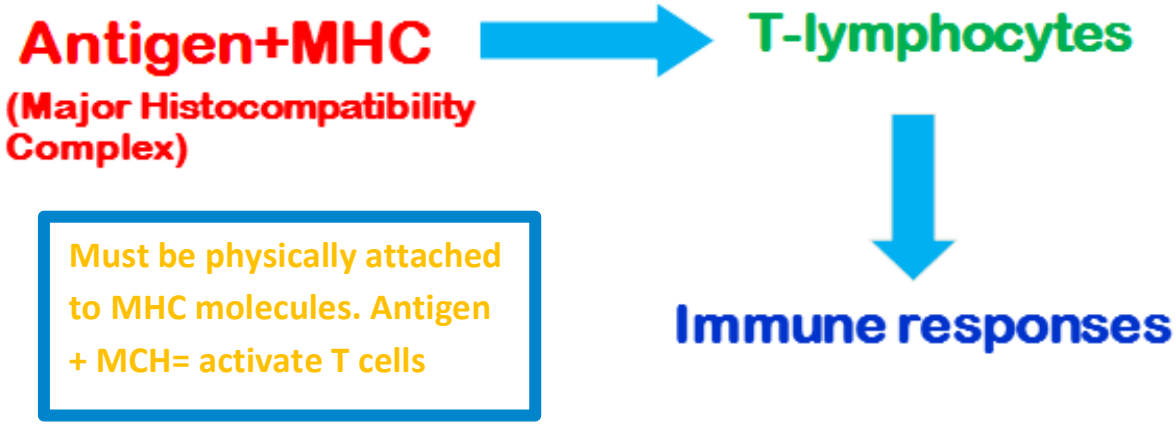
- **Cell mediated immunity (CMI) occurs in mononuclear cells.**
- **The nature of the antigen decides whether the body is going to react with antibodies (Humoral response) OR T Cells (Cell mediated response).**
- **Remember that :**
- **1- T Lymphocytes (CD8, CD4) are (responding cells).**
- **2- Antigen Presenting cells (APC): Monocytes-macrophages-B cells-dendritic-Langerhans cells.**
- **Note that all these cells (APC) mononuclear cells are in the chronic inflammation process only (not acute).**

- In chronic inflammation: the mononuclear cells increase.

-In Acute inflammation: the neutrophils (PMN) (multi -nucleated cells) increase.

- Langerhans cells: are macrophages presented on the skin with different morphology. Associated with B cells and antibodies (has to do with humeral immunity.

Cell-Mediated Immunity (CMI)



○ Major Histocompatibility Complex (MHC):

- **Major histocompatibility complex (MHC) proteins were discovered for the first time with when tissue transplantation started.**
- **The success of tissue and organ transplantation depends upon the match of donor's and recipient's "*human leukocyte antigens*" (HLA) encoded by HLA genes.**
- **Genes for HLA proteins are clustered in the MHC complex located on the short arm of chromosome 6 (Remember that RBCs = No nuclease → No Chromosomes → No MHC)**

○ MHC:

- **Three genes code for Class I MHC molecules**
  HLA-A,
  HLA-B
  HLA-C
- **HLA-D loci encode for Class II MHC molecules ie,**
  DP
  DQ
  DR

Each group of MHC consists of several glycoproteins.

- Note: every cell in your body has a specific special unique set of MHCs that matches your body. That's why rejection process occurs when some organs are transferred.

-Your MHC is different from you parents and each one of us carries a combination of HLA-A, HLA-B ….etc.

For example, your mom carries A1, B6, C9 and you carry A6, B3, and C9.

Even between the siblings they are slightly different from each other.

- **Each individual has two "haplotypes" i.e., two sets of these genes one paternal and one maternal.**

- **MHC Class I molecules are found on the surface of virtually all nucleated cells.**

-MHC class1 attach to endogenous antigens and activate T cells (CD8).

- **MHC Class II molecules are normally present of the surface of antigen presenting cells such as:**

Macrophages

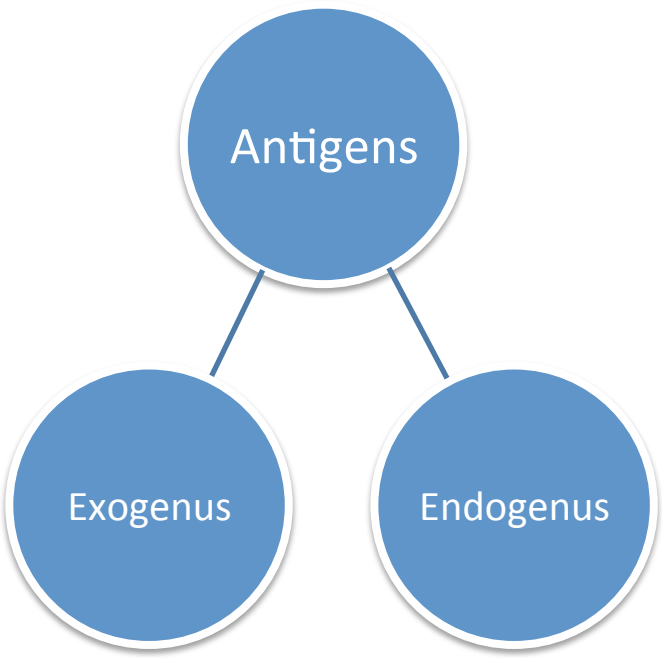
Dendritic cells

Langerhans cells of skin

B cells

- MHC class 2 attaches to exogenous antigens and activates T cells (CD4 (helper cells) -boost immune system-)

-The known DNA parental testing is actually based on MHCs, and it is another way other than using RBCs.



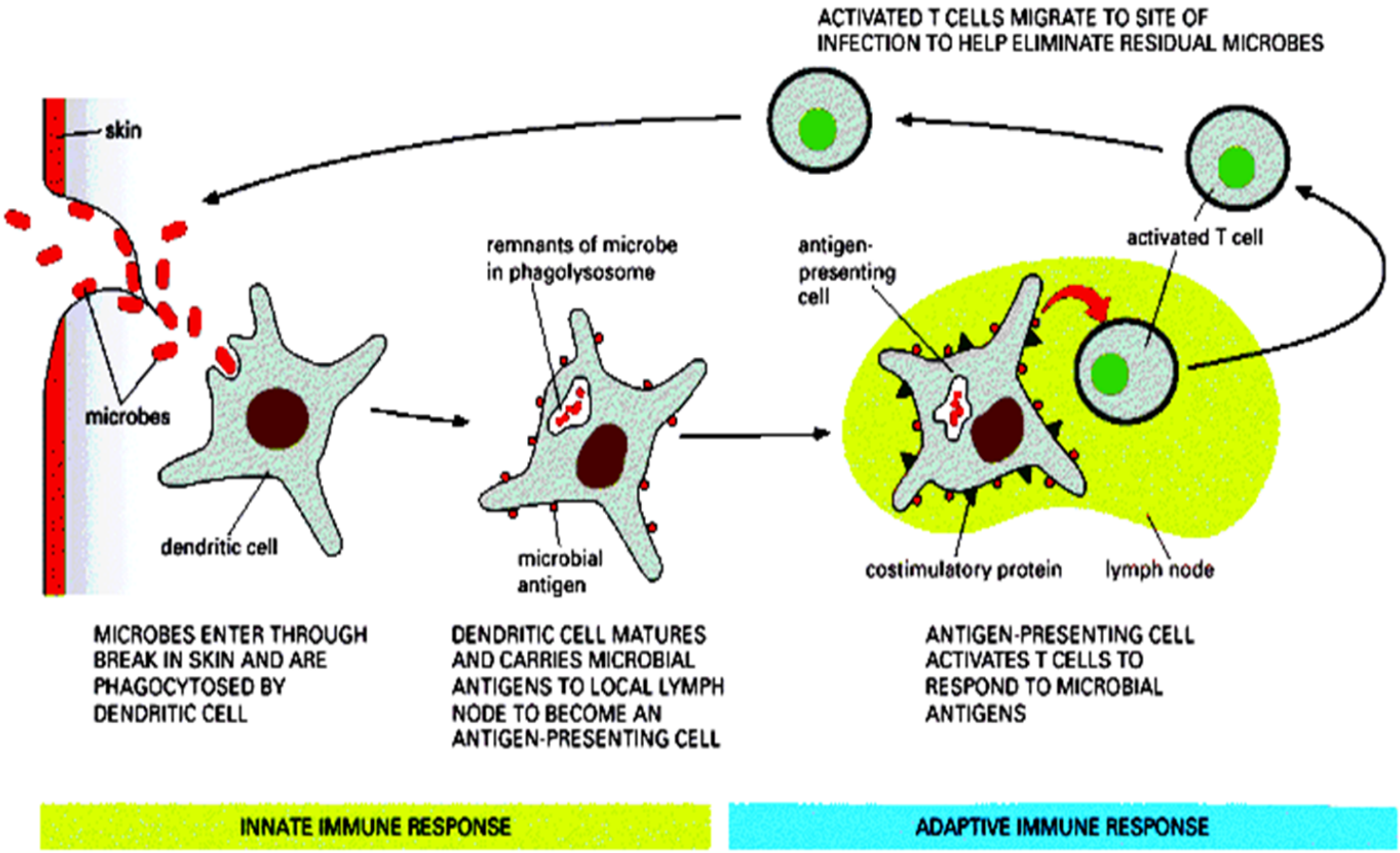
MHC's Job :

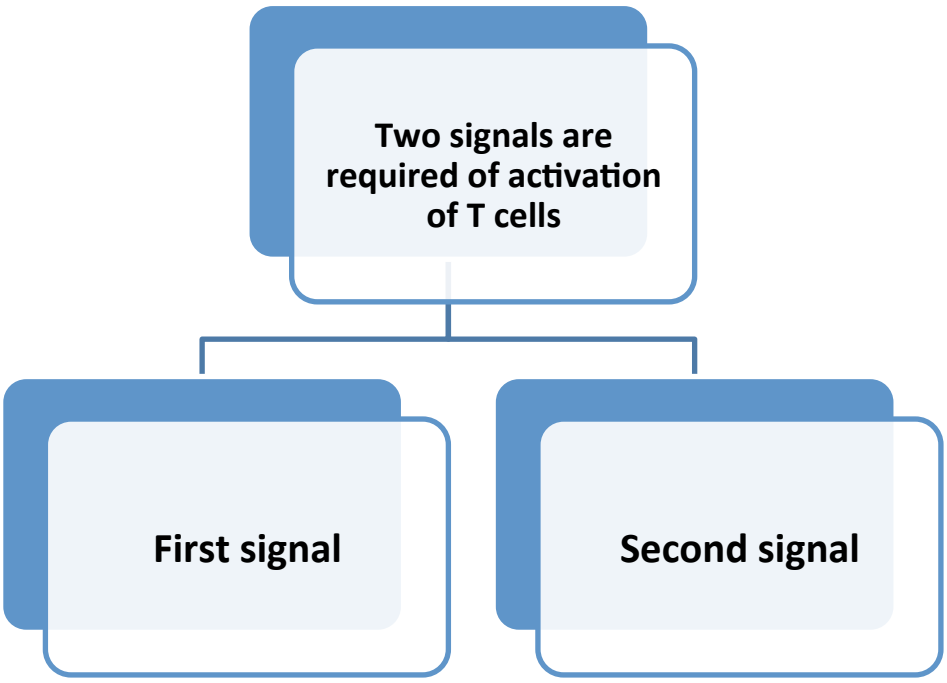
antigen presentation

transplantation rejection

○ Antigen presenting cells:

Dendritic cells and macrophages digest invading microbe and then present the antigen of the microbe to lymphocytes in lymphoid organs.





-Both signals should be completed otherwise T cells won't be activated.

- Outcome of T helper cells activation (Release cytokines):

- **Production of IL-2 and its receptor**

  -IL-2 is also known as T cell growth factor

  -Proliferation of antigen specific T cells

  -Effector and regulatory cells are produced along with ***"memory"*** cells.

  -IL-2 also stimulates CD8 cytotoxic cells

- **Production of Interferons**

  -Enhances anti-microbial activity of macrophages

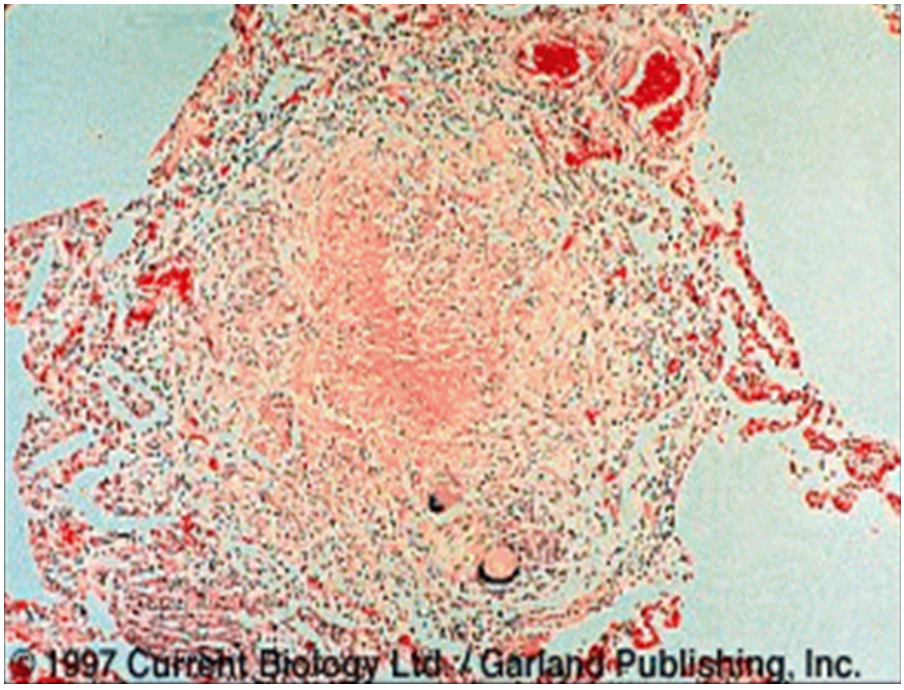
○ Memory T-Cells:

- **Respond rapidly for many years after initial exposure to antigen**
- **A large number of memory cells are produced so that the secondary response is greater than the primary**
- **Memory cells live for many years and have the capacity to multiply**
- **They are activated by smaller amount of antigen**
- **They produce greater amounts of interleukins**

-When you have memory cells, lymphocytes will react directly with the same antigen without the need for macrophages.

○ Granuloma formation (Chronic inflammation):

-In granuloma, huge mass of APC (macrophages) surrounded by lymphocytes that press the macrophages inside.



○ Examples of Cell Mediated Immunity

1. **Delayed type of hypersensitivity (DTH) reaction:**

   The tuberculin test

   – **Mediated by CD4+ T cells and takes about 72 hours to develop**

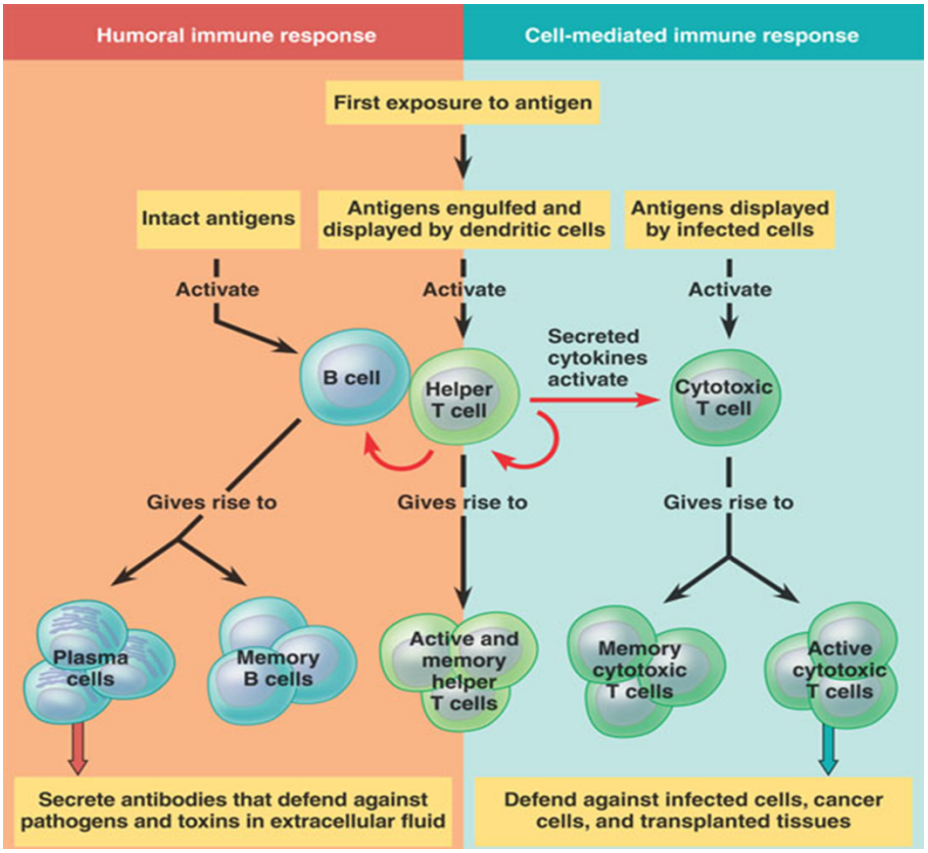
2. **Contact Sensitivity**

   – **Many people develop rashes on their skin following contact with certain chemicals such as nickel, certain dyes, and poison ivy plant.**

   – **The response takes some 24 hours to occur and like DTH, is triggered by CD4+ T cells.**

○ Summary:

Useful link: http://www.youtube.com/watch?v=rp7T4IItbtM



We are not perfect, but with your help, our work can be flawless..

Please don’t hesitate to contact us:

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Good luck

(لا تنسونا من صالح دعائكم)